HUMAN SPACE FLIGHT

FISCAL YEAR 2003 ESTIMATES

BUDGET SUMMARY

OFFICE OF SPACE FLIGHT | **SPACE COMMUNICATIONS AND DATA SYSTEMS**

SUMMARY OF RESOURCES REQUIREMENTS

Web Address: http://www.jsc.nasa.gov/somo/

	FY 2001 OP PLAN REVISED	FY 2002 INITIAL OP PLAN	FY 2003 PRES BUDGET	Page Number
	(Millions of Dollars)			
Operations	361.2	318.8	82.1	HSF 5-4
Upgrades	73.8	25.4	1.4	HSF 5-14
Tracking and Data Relay Satellite System Replenishment Project	50.9	117.5	16.5	HSF 5-19
Technology Infusion	35.8	20.5	17.5	HSF 5-22
*[Budget Offsetting Reimbursements [non-add]]	[43.0]	[45.0]	[45.0]	
Total	521.7	482.2	117.5	
Distribution of Program Amount by Installation				
Johnson Space Center	247.6	26.9	21.0	
Kennedy Space Center	37.1	74.2	8.9	
Marshall Space Flight Center	9.5	72.8	57.1	
Dryden Space Flight Center	12.8	12.4	--	
Glenn Research Center	8.6	3.5	3.4	
Goddard Space Flight Center	79.9	111.0	14.3	
Jet Propulsion Laboratory	123.9	175.2	7.5	
Headquarters	2.3	6.2	5.3	
Total	521.7	482.2	117.5	

Note: The Space Communications and Data Systems Program was titled the Space Operations Program in FY 2001 and FY 2002 budgets.
* Budget offsetting reimbursements are that portion of total program reimbursable revenue that partially defray the fixed and variable costs of operating a NASA multi-mission facility as a service to a variety of NASA and non-NASA users.

SPACE COMMUNICATIONS AND DATA SYSTEMS LINKAGE TO STRATEGIC PLAN

Strategic Plan Goals Supported:
- Enable humans to live and work permanently in space
- Enable the commercial development of space

Strategic Plan Objectives Supported:
- Meet sustained space operations needs while reducing costs
- Develop new capabilities for Human Space Flight and commercial applications through partnerships with the private sector

The program supports NASA's Enterprises and external customers with Space Communications and Data Systems (SCDS) services that are responsive to customer needs. The program performs infrastructure upgrades and replenishment efforts necessary to maintain the service capability that satisfy the approved mission model. The program conducts technology and standards infusion efforts to provide more efficient and effective services. The program provides operational services through major SCDS factories including the Ground Networks (GN), Space Network (SN), Deep Space Network (DSN), Wide Area Network (WAN), and Western Aeronautical Test Range (WATR).

In line with the National Space Policy, the program is committed to seeking and encouraging commercialization of NASA communications services and to participate with NASA Enterprises in collaborative inter-agency, international, and commercial initiatives. NASA procures commercially available goods and services to the fullest extent feasible, and enables the use of existing and emerging commercial telecommunication services to meet NASA's SCDS needs. The Space Communications program has undertaken the following commercialization initiatives: (1) WAN data distribution services, (2) ground-based tracking and data services at Svalbard, Norway, (3) ground-based tracking and data services at Poker Flats, Alaska, and (4) commercial replacement ofMerritt Island Launch Area /Ponce de Leon (MILA/PDL).

A decentralized management process basis is being implemented that involves transferring management functions previously performed by the Space Operations Management Office (SOMO) at the Johnson Space Center to NASA Headquarters. The transition process begins in FY 2002 with the transfer of certain technology infusion and upgrades tasks, and project unique capabilities to the appropriate Enterprises. The Deep Space Network will be managed by the Office of Space Science, the Ground Networks will be managed by the Office of Earth Science, and the Western Aeronautical Test Range will be managed by the Office of Aerospace Technology beginning in FY 2003. Information about these networks can be found in the respective sections of each Enterprise responsible for that network. The Office of Space Flight will perform overall program integration, including management of the Consolidated Space Operations Contract (CSOC). With the decentralized approach, funding for space communication activities has been spread throughout the agency. Below is a chart summarizing the total budget for space communication activities in the agency.

ENTERPRISE BUDGET SUMMARY

$ in Millions	FY 2001	FY 2002	FY 2003
Space Communications Program (Code M)	**521.7**	**482.2**	**117.5**
TDRS Replenishment	50.9	117.5	16.5
Upgrades	73.8	25.4	1.4
Operations	361.2	318.8	82.1
Technology Infusion	35.8	20.5	17.5
Enterprise Mission Requirements	**156.2**	**232.9**	**527.7**
Space Flight (Code M)	104.8	132.8	197.9
Space Science (Code S)	10.3	57.2	234.2
Earth Science (Code Y)	40.7	42.2	82.9
Aerospace Technology (Code R)	0.3	0.7	12.7
TOTAL SPACE OPERATIONS	**677.8**	**715.1**	**645.2**

BASIS OF FY 2003 FUNDING REQUIREMENT

OPERATIONS

	FY 2001	FY 2002	FY 2003
		(Millions of Dollars)	
Operations Integration	58.8	28.8	18.8
Ground Networks	33.6	39.6	1.0
Space Network	7.0	--	--
Deep Space Network	142.2	154.3	--
Wide Area Network	99.7	77.0	57.1
Western Aeronautical Test Range	12.5	12.0	--
Spectrum Management	4.5	2.5	0.6
Standards Management	0.3	0.7	0.7
Navigation & Communications Architecture	--	0.3	0.3
Program Management Support	2.6	3.6	3.6
Total	361.2	318.8	82.1

DESCRIPTION/JUSTIFICATION

The operations functions for Space Communications are defined as those activities that provide data services to customers to enable their utilization and exploration of space. The goal is to provide high-quality, reliable, cost-effective operations that support planning, system engineering, design, development, and analysis to a large number of NASA missions including planetary and interplanetary missions; human space flight missions; near-Earth and Earth-orbiting missions; sub-orbital and aeronautical test flights.

Data services operations are conducted in the facilities provided by NASA at multiple locations both in the United States and at overseas sites. Data Services provide command, tracking, and telemetry data services between the ground facilities and flight mission vehicles. This includes all the interconnecting telecommunications services to link tracking and data acquisition network facilities, mission control facilities, data capture and processing facilities, industry and university facilities, and the investigating scientists.

Data services are also provided to non-NASA customers on a reimbursable basis. Space Network ground terminal complex operations and maintenance at White Sands Complex (WSC) and Network Control Center (NCC) functions at Goddard Space Flight Center (GSFC) are funded with budget offset reimbursements.

The Space Network (SN) encompasses the WSC in New Mexico, the Guam Remote Ground Terminal, and the NCC at GSFC to operate the constellation of Tracking and Data Relay Satellites (TDRS). The SN is required to operate 24 hours per day, 7 days per week, providing data relay services to many flight missions. The Space Network extended service (on a reimbursable basis) to the expendable launch vehicle community, including agreements with US Air Force Titan, Lockheed Martin's commercial Atlas programs, and Boeing's Delta program

The Deep Space Network (DSN) includes the Goldstone Deep Space Communications Complex (GDSCC) in California, the Madrid Deep Space Communications Complex (MDSCC) in Spain, and the Canberra Deep Space Communications Complex (CDSCC) in Australia.

The Ground Networks (GN) is comprised of tracking stations in Poker Flats Research Range in Alaska, Merritt Island Launch Annex (MILA) in Svalbard, Norway, McMurdo Ground Station in the Antarctic, and Wallops Flight Facility. The GN provides launch support, polar orbiting Spacecraft support, and sounding rocket and atmospheric balloon mission support. The GN also supports critical Space Shuttle launches, emergency communications, and landing activities, as well as emergency communications and tracking support for the International Space Station. The GN provides for the implementation, maintenance, and operation of the tracking and communications facilities necessary to fulfill program goals for flight projects in the NASA mission set. Missions supported also include NASA inter-agency collaborative programs, and other national, international, and commercial enterprises on a reimbursable basis. Space Shuttle launches are supported through dedicated facilities of the MILA station and the Ponce de Leon inlet annex.

Dryden Flight Research Center (DFRC) Western Aeronautical Test Range (WATR) provides communications, tracking, data acquisition, and mission control for a wide variety of aerospace vehicles. The WATR meets widely diverse research project requirements with tracking, telemetry, and communication systems and control room complexes. Due to the nature of the aerospace research mission, it is essential to respond to new project requirements within days or weeks rather than months or years, and to do so safely, efficiently, and economically. To accomplish this, WATR facilities, systems, and processes are designed to support a wide range of requirements, to be easily reconfigured (less than one hour for control rooms), to be shared between multiple projects, and to readily interface with specialized equipment brought in by our customers. This approach provides the needed agility to be responsive to individual customers by increasing utilization rates

Mission control facilities operated and sustained under this program are Mission Operation Centers (MOC) for the Hubble Space Telescope (HST) program; the International Solar Terrestrial Physics (ISTP) Wind, Polar, and Solar Observatory for Heliospheric Observation (SOHO) missions; Rossi X-ray Timing Explorer (RXTE), Total Ozone Mapping Satellite- Earth Probe (TOMS-EP), Solar, Anomalous, and Magnetospheric Particle Explorer (SAMPEX); Transport Region and Coronal Explorer (TRACE); Submillimeter Wave Astronomy Satellite (SWAS) mission, and the Multi- satellite Operations Control Center (MSOCC) which supports Upper Atmosphere Research Satellite (UARS) and Earth Radiation Budget Satellite (ERBS) missions. The Advanced Composition Explorer (ACE), Tropical Rainfall Measurement Mission (TRMM), Earth Observing (EO-1) and Land Satellite (Landsat- 7) are also operated out of GSFC MOCs.

The data processing function captures Spacecraft data received on the ground, verifies the quantity and quality of the data, and prepares data sets ready for scientific analysis. The data processing facilities perform the first order of processing of Spacecraft data (Level 0) prior to its distribution to science operations centers and to individual instrument managers and research teams

The Flight Dynamics Facility (FDF) provides a variety of services to its customers, including orbit determination and control, attitude determination and control, acquisition data generation, tracking network calibration, attitude and orbit maneuver design and planning, and other related services. The orbiting missions include ACE, ERBS, HST, the GOES series, RXTE, the TDRS series, TERRA, TOMS-EP, TOPEX, TRACE, TRMM, and UARS, as well as ISS.

The Wide Area Network (WAN) provides for the implementation, maintenance, and operation of the telecommunications services, control centers, switching systems, and other equipment necessary to provide an integrated approach to NASA communications requirements.

Spectrum management support is provided for all missions across the NASA strategic enterprises. Future spectrum and orbit requirements are identified and integrated into National and international regulatory activities to assure near-term and far-term Agency requirements are met.

Standards Management responsibilities include establishing NASA space data systems standards policy, providing strategic direction, and maintaining oversight of the NASA space data systems program.

LINKAGES TO STRATEGIC AND PERFORMANCE PLANS

Strategic Plan Goals Supported:
- Enable humans to live and work permanently in space
- Enable the commercial development of space

Strategic Plan Objectives Supported:
- Meet sustained space operations needs while reducing costs
- Develop new capabilities for Human Space Flight and commercial applications through partnerships with the private sector

Performance Plan Metrics Supported:
1H20, 1H21

Milestones	FY 2003 Budget	FY 2002 Budget	FY 2001 Budget	FY 2002-FY 2003 Change	Comment
Number of FY 2001 Space Shuttle launches supported by Space Network	7	7	9	–	
Number of hours of space network services planned for FY 2001	71000	61000	61000	10000	Change in calculation methodology to more accurately reflect actual support
Number of NASA Integrated Systems Network (NISN) physical locations connected in FY 2001	295	340	420	-45	Due to the NISN/Wide Area Networks active peering relationships, the WAN has eliminated many dedicated services to principal researchers at domestic locations.
Number of FY 2001 NASA Deep Space Network Missions supported	47	47	47		
Number of hours of Deep Space Network Service planned for FY 2001	80,000	81,000	81,000	-1,000	Number of hours of services is continually renegotiated throughout the year based on launch slips, unplanned maintenance and mission support requirements.
Number of NASA/Other ELV launches for Ground Networks planned for FY 2001	21	25	54	-4	Launch slip and delays/project cancellations
Number of NASA Earth-Orbiting Missions in FY 2001	37	37	32	-	
Number of Sounding Rocket deployments in FY 2001	12	12	25	-13	Launch slips/delays
Number of Balloon deployments (scientific) in FY 2001	26	26	26	--	
Number of hours in FY 2001 for Ground Networks orbital tracking	23,532	25,200	23,000	-1,668	Launch slips/delays

Milestones	**FY 2003 Budget**	**FY 2002 Budget**	**FY 2001 Budget**	**FY 2002- FY 2003 Change**	**Comment**
Number of hours of Western Aeronautical Test Range mission control center in FY 2001	4,546	1,875	1,875	2,671	Higher than planned mission control hours due to increased support for X-43
Number of hours of data services support for Western Aeronautical Test Range in FY 2001	27,399	27,000	27,000	399	Data services support was provided to 3 unscheduled Shuttle landings.
Number of NASA Spacecraft supported by GSFC mission control facilities for Mission and Control Data Services in FY 2001	22	22	25	-	
Number of mission control hours of service (in thousands) in FY 2001	48,992	58,000	62,000	-9,008	Launch slips/delays
Number of NASA/Other missions provided flight dynamic services in FY 2001	37	45	49	-8	Launch delays/project cancellations
Number of NASA/Other ELV launches supported by flight dynamic services in FY 2001	20	20	22	-	
Number of FY 2002 Space Shuttle launches supported by Space Network	7	7	7	--	
Number of hours of space network services planned for FY 2002	79,919	61,000	61,000	18,919	Change in calculation methodology to more accurately reflect actual support

Milestones	FY 2003 Budget	FY 2002 Budget	FY 2001 Budget	FY 2002-FY 2003 Change	Comment
Number of NASA Integrated Systems Network (NISN) physical locations connected in FY 2002	295	323	323	-28	Due to the NISN/Wide Area Networks active peering relationships, the WAN has eliminated many dedicated services to principal researchers at domestic locations.
Number of FY 2002 NASA Deep Space Network Missions supported	50	51	51	-1	Deep Space Network Support to reimbursable missions has been reduced.
Number of hours of Deep Space Network Service planned for FY 2002	85,000	84,000	84,000	1,000	Starting in FY 2002, delta differenced one-way ranging (Delta DOR) is a requirement for all DSN sites, causing a minimal increase in usage.
Number of NASA/Other ELV launches for Ground Networks planned for FY 2002	26	25	25	1	Launch delays/project cancellations
Number of NASA Earth-Orbiting Missions in FY 2002	44	37	37	7	Mission support extensions in addition to launches
Number of Sounding Rocket deployments in FY 2002	41	25	25	16	FY 2001 delayed launches shifted to FY 2002
Number of Balloon deployments (scientific) in FY 2002	23	26	26	-3	Weather and other factors reduced total deployment
Number of hours of service (Ground Networks orbital tracking) in FY 2002	25,200	25,200	25,200	--	
Number of hours of Western Aeronautical Test Range mission control center in FY 2002	6,980	1,875	1,875	5,105	Higher than planned mission control hours due to increased support for X-43.

Milestones	FY 2003 Budget	FY 2002 Budget	FY 2001 Budget	FY 2002-FY 2003 Change	Comment
Number of hours of data services support for Western Aeronautical Test Range in FY 2002	30,000	30,000	30,000	--	
Number of NASA Spacecraft supported by GSFC mission control facilities for Mission and Control Data Services in FY 2002	23	23	23	--	
Number of mission control hours of service (in thousands) in FY 2002	58,000	58,000	58,000	--	
Number of NASA/Other missions provided flight dynamic services in FY 2002	38	46	46	-8	Launch delays/project cancellations
Number of NASA/Other ELV launches supported by flight dynamic services in FY 2002	30	30	30		
Number of FY 2003 Space Shuttle launches supported by Space Network	4	4	4		
Number of hours of space network services planned for FY 2003	81,479	81,479	81,479		
Number of NASA Integrated Systems Network physical locations connected in FY 2003	285	285	285		

Lead Center: Johnson Space Center	**Other Centers:** Goddard Space Flight Center, Jet Propulsion Laboratory, Marshall Space Flight Center, Dryden Flight Research Center, Headquarters, Glenn Research Center, Kennedy Space Center
Networks: Deep Space Network Space Network Ground Networks Wide Area Network	
Major Contractors: Lockheed Martin Australian Space Office Ingenieria Y Servicios Aeroespaciales, S.A.	

PROGRAM STATUS/NOTIFICATIONS/PLANS THROUGH 2002

The Space Network will continue to provide services to the Space Shuttle flights and their attached payloads as well as the construction phase of the International Space Station.

The number of missions serviced by the Deep Space Network facilities and the requirements of the individual missions will increase over the next several years. In anticipation of the increases, new antenna system capabilities are being developed and obsolete systems will be phased out or converted for alternate uses. FY 2001 was a busy period with numerous mission-critical events, including launches, seven Spacecraft emergencies, three Jovian moon encounters, and a spectacular asteroid landing. In FY 2001, major mission launches supported include Mars Odyssey in April, Microwave Anisotropy Probe (MAP) in June, and Genesis in August. Galileo encountered Ganymede in December 2000, Callisto in May 2001, and Io in August 2001. Finally, the Near-Earth Asteroid Rendezvous (NEAR) mission made a historic, first time ever landing on an asteroid, when it landed on the Earth Resource Observation System (asteroid EROS on February 12, 2001. The DSN navigation team supported the descent sequence design. FY 2002 also has many significant activities planned. Mars Odyssey begins its mapping of Mars in January. This will increase the tracking load on the DSN and require regular use of the DSN's new Multiple Spacecraft Per Aperture (MSPA) capabilities for the first time. Galileo's thirty-third encounter with Io is planned for late January. The DSN expects to support ten launches through the year, including TDRS in March, followed by HESSI, Pro-SEDS, Contour, SIRTF, MUSES-C, and Integral.

In the area of Ground Networks, operations of the tracking station at Svalbard, Norway, have been consolidated under a commercial provider, Space Data Services. Operations of the tracking station at Poker Flats, Alaska, are planned to be consolidated under a commercial provider in FY 2002.

The Western Aeronautical Test Range saw its agility put to the test in FY 2001 when its traditional customer base diversified. The new customer base includes a greater number of experimental vehicles, Unpiloted Aerial Vehicles (UAVs), and access-to-space vehicles that bring with them a greater amount of mission unique requirements. In addition to local DFRC customers, the WATR supports other NASA Centers, the U.S. Army, U.S. Air Force, U.S. Navy, Federal Aviation Administration, and the aerospace industry. Three unscheduled Edwards AFB Shuttle landings were supported in FY 2001. Significant FY 2001 and FY 2002 activities include the build-up of a Mission Control Center and data processing system to support unique X- 40A, and X-43 (Hyper- X) requirements. Initially, a work-around was developed to support classified data on the first flight of the X-43. However, additional modifications to the Mission Control Complex will be required for future X-43 missions. The extended test range, developed with our alliance partners, will be maintained for use on future X-43 missions. Mobile tracking systems will be used more frequently for remote deployments in support of a variety of UAVs.

The Microwave Anisotropy Probe (MAP), the second Medium-class Explorer (MIDEX) was launched during FY 2001 and mission control facilities are now operating and sustained under this program. The International Monitoring Platform (IMP-8) completed its mission in October 2001 after 27 years of service.

The Earth Observation System (EOS) Data and Operations System (EDOS) began supporting the EOS Terra (AM- 1) mission and is preparing for the second mission of the EOS series, Aqua (PM- 1) currently planned for March 2002. EDOS provides the science data processing capability and product generation and delivery for the EOS missions. In addition, the Terra mission is supported via the SN and transmits telemetry to the EDOS Ground System Interface Facility (GSIF) located at the WSC for storage and delivery to the EDOS Level Zero Processing Facility located at GSFC. Data processing is also provided for the ISTP missions (Geotail, WIND, Polar and SOHO), SMEX missions (SWAS, SAMPEX, TRACE and FAST), ACE, TOMS-EP, EO-1, and RXTE. A new system, Packet Processor (PACOR) Automation, will provide Level-0 processing for HST, TRMM, UARS, and ERBS and reduce operations costs while continuing to meet product delivery and data recovery requirements. Higher level data processing (Levels 1-3) is provided for the ISTP and UARS missions, with UARS support ending November 2002.

The Flight Dynamics Facility (FDF) provides a variety of services to its customers, including orbit determination and control, attitude determination and control, acquisition data generation, tracking network calibration, attitude and orbit maneuver design and planning, and other related services. The orbiting missions include ACE, ERBS, HST, the GOES series, RXTE, the TDRS series, TERRA, TOMS-EP, TOPEX, TRACE, TRMM, and UARS, as well as ISS. During FY 2002, the level of support from the Flight Dynamics Facility for current and future missions is expected to increase due to the aging onboard sensors and actuators, requiring additional analysis, different algorithms, and processing. Some notable missions to be launched in FY 2002 are EOS AQUA (PM-1), the High Energy Spectroscopic Imager (HESSI), the Galaxy Evolution Explorer (GALEX), and the Servicing Mission 3B for HST. In addition, in FY 2002, as the Network Control Center functions migrate from Building 13 of Goddard to the White Sands Complex, FDF will move from the current location in Building 28 to Building 13 with a back-up facility in Building 25, providing more reliable and robust capabilities to its customers.

The Wide Area Network (WAN) continues to expand its service offerings while reducing overall cost. During FY 2001, the WAN backbone capacity was expanded by 20 percent while reducing cost per kilobit by 17 percent. In FY 2002, the WAN will begin to upgrade the infrastructure utilized by its operational mission network. NASA will be adding services to support continued implementation of IFMP, Consolidated Supercomputing Management Office (CoSMO), ISS Phase II, National Oceanic and Atmospheric Administration (NOAA)-K, Earth Observation System, Advanced Composition Explorer (ACE), Advanced Earth Observing Satellite (ADEOS) and TRMM. Additional tasks planned for FY 2002 include further definition of the Mission Network Modernization project, including the design and implementation plan, and more interactive tools for network problem resolution and reporting to customers. Investigations planned for FY 2002 include video conferencing over Internet Protocol, while keeping an interface to current ISDN connected systems, collaborative data sharing tools to incorporate into video teleconferencing service, and future platform for network services.

The Spectrum Management program began preparations for the 2003 World Radiocommunications Conference (WRC- 2003). Study efforts were conducted and contributed to International Telecommunications Union study groups to prepare the technical bases for Agency proposals to WRC- 2003. These efforts include enhancement of frequency allocations for spaceborne radars, protection of vital tracking and data relay capabilities, and ensuring the protection of sensitive signals from deep space scientific research. The program leverages its activities through coordination with other civil space agencies throughout the World by participation in the Space Frequency Coordination Group (SFCG). The 2001 SFCG meeting was hosted by the French Space Agency, CNES, near their launch complex in French Guiana. The program is also helping to foster NASA's commercialization goals by working with the National regulatory agencies to solve the associated regulatory challenges. The program will continue to support NASA missions in obtaining national and international authority to operate in a protected and properly allocated manner.

PROGRAM PLANS FOR FY 2003

The SN is required to operate 24 hours per day, 7 days per week, providing data relay services to numerous flight missions. The SN will continue to provide for the implementation, maintenance, and operation of the communications systems and facilities necessary to ensure and sustain the high-quality performance to our NASA and non-NASA customers. The SN will continue to provide services to the Space Shuttle flights and their attached payloads as well as the construction phase of the International Space Station.

The WAN provides for the implementation, maintenance, and operation of the telecommunications services, control centers, switching systems, and other equipment necessary to provide an integrated approach to NASA communications requirements. Plans for FY 2003 include the initial installations of the Mission Network Modernization project for improved technology and performance in providing mission services to both manned and unmanned space programs; and the introduction of voice over Internet protocol into the mission infrastructure allowing a low cost solution to NASA's principle investigators participating in NASA's missions. NASA's peering agreements will continue to be improved to provide NASA greater connectivity to the university and research networks without expensive dedicated circuits to those locations.

Consistent with the new decentralized management process, the Deep Space Network will be managed by the Office of Space Science, the Ground Networks will be managed by the Office of Earth Science, and the Western Aeronautical Test Range will be managed by the Office of Aerospace Technology beginning in FY 2003. Information about these networks can be found in the respective sections of each Enterprise responsible for those networks.

BASIS OF FY 2003 FUNDING REQUIREMENT

UPGRADES

	FY 2001	FY 2002	FY 2003
		(Millions of Dollars)	
Mission Services	33.9	--	--
Data Services	39.9	25.4	1.4
Total	73.8	25.4	1.4

DESCRIPTION/JUSTIFICATION

The goal of the Upgrades Project is to improve the communications and data capabilities available to NASA's Enterprises by implementing required upgrades to space communications systems and services. Reliable electronic communications and mission control systems are essential to the success of every NASA flight mission, from planetary Spacecraft to the Space Shuttle to aeronautical flight tests.

Upgrades are made to the Space Network, Deep Space Network, and Ground Networks. These areas establish, operate, and maintain NASA facilities to provide communications services to a variety of flight programs. These include deep space, Earth-orbital, research aircraft, and sub-orbital missions.

Upgrade tasks are being conducted on the Space Network, the Deep Space Network, and the Ground Networks to enable the conduct of on going and new missions by the NASA strategic Enterprises. The Goddard Space Flight Center (GSFC), the Jet Propulsion Laboratory (JPL), and their respective industry partners implement these upgrades.

A major upgrade effort is underway to reduce operations costs for the Space Network and Ground Networks through the implementation of the Data Services Management Center at the White Sands Complex (WSC) in New Mexico. This effort involves consolidating scheduling, management, and control of operations for the Space Network and Ground Networks, including relocating the Network Control Center (NCC) from GSFC to WSC. The NCC, the primary interface for all SN customer missions, provides scheduling for customer mission services. In addition, the NCC generates and transmits configuration control messages to the network's ground terminals and TDRS satellites and provides fault isolation services for the network. The Upgrades Project provides comprehensive mission planning, user communications systems analysis, mission analysis, network loading analysis, and other customer services and tests to ensure network readiness and technical compatibility for in-flight communications.

In the Deep Space Network (DSN) area, JPL is working with its industry contract partners to transform the DSN and associated mission operations system architecture into a service provision system known as the Deep Space Mission System (DSMS). The

DSMS will provide a customer-oriented, turn-key service system, which seamlessly integrates the facilities of the DSN, and the Advanced Multi-Mission Operations System (AMMOS). This system will enable more efficient provision of currently available services as well as the creation of entirely new services.

Beyond efficiency improvements to existing assets, NASA is exploring ways to enhance the amount of deep space communications capability that can be applied to servicing the growing exploration fleet. NASA efforts along these lines include international cooperation and technology upgrades to existing assets.

In the international cooperation arena, NASA, through JPL, is working with other space-faring nations to implement a standardized set of communications protocols that will allow Spacecraft interoperability with U.S. and foreign ground communications assets. NASA is also working to establish the agreements necessary to utilize such interoperability, such as the possible application of Italy's planned 64-meter Sardinia antenna to the support of some U.S. deep space missions.

JPL is working to improve capacity through data processing and antenna feed enhancements at current radio frequencies and through the application of higher radio, and even optical, frequencies. This will enable significant leaps in the data rates available for future missions. The first major new radio frequency improvements involve the addition of Ka-band reception capability on all of the Deep Space Network's 34-meter beam wave-guide antennas. NASA is also working to develop the corresponding Ka-band transmission hardware needed for the flight elements. In addition, the Office of Space Science's Mars Exploration Program implemented the building of an additional 34-meter beam wave-guide antenna in Spain to meet DSN mission loading requirements.

Efforts to reduce the cost of operations for low-Earth orbit Spacecraft will continue with the commercialization of ground based tracking systems. The goal of these efforts is to provide a low-cost ground tracking capability utilizing commercial ground tracking services in lieu of building additional government assets. This concept is being validated by the NASA/Consolidated Space Operations Contract polar tracking services contracts with the Honeywell DataLYNX and Space Data Services contractors in support of the Earth Observing System (EOS) Program.

LINKAGES TO STRATEGIC AND PERFORMANCE PLANS

Strategic Plan Goals Supported:
- Enable humans to live and work permanently in space
- Enable the commercial development of space

Strategic Plan Objectives Supported:
- Meet sustained space operations needs while reducing costs
- Develop new capabilities for Human Space Flight and commercial applications through partnerships with the private sector

Performance Plan Metrics Supported:
1H20, 1H21

Milestones	**FY 2003 Budget**	**FY 2002 Budget**	**FY 2001 Budget**	**FY 2002-FY 2003 Change**	**Comment**
Data Services Management Center (DSMC)	3rd Qtr FY 2002	3rd Qtr FY 2002	3rd Qtr FY 2002	--	The DSMC consolidates Ground Networks (GN) and Space Network (SN) scheduling and service accounting functions at the White Sands Complex (WSC) to reduce operations costs.
Ground Networks - McMurdo Ground Station Upgrades	4th Qtr FY 2002	2nd Qtr FY 2001	2nd Qtr FY 2001	6 Qtrs later	Upgrade the existing facility (joint with the USAF) to improve operability during inclement weather and support future cooperation with the USAF. Competing priorities for technical staff and constrained implementation season at McMurdo station resulted in schedule slip
Mission Services – PACOR Automation	2nd Qtr FY 2002	3rd Qtr FY 2001	3rd Qtr FY 2001	3 Qtrs later	Automate and upgrade existing data processing systems to reduce operations costs. Under estimated complexity and scope of software development effort resulted in schedule slip.
Ka-Band Ground Terminal Development	2nd Qtr FY 2002	4th Qtr FY 2001	4th Qtr FY 2001	2 Qtrs later	Implement a Ka-Band ground terminal to test and demonstrate high rate ground data acquisition at this higher frequency. The manufacturer has experienced technical difficulties while develpping the higher frequency RF components required for Ka-band.
Space Network Demand Access System	3rd Qtr FY 2002	1st Qtr FY 2002	1st Qtr FY 2002	2 Qtrs later	Implement an improved Space Network multiple access system to provide increased capacity to support new operational uses of the TDRSS. Under estimated complexity and scope of software development effort resulted in schedule slip.

Milestones	FY 2003 Budget	FY 2002 Budget	FY 2001 Budget	FY 2002- FY 2003 Change	Comment
Deep Space Network DSS-26 Antenna implementation	3rd Qtr FY 2003				Implement a 34M deep space antenna with X-Band and Ka-Band downlink capability.
Deep Space Network - Network Simplification Project	3rd Qtr FY 2003				Automate and upgrade existing tracking, telemetry, and command systems to increase reliability and reduce operations costs.

Lead Center:	**Other Centers:**
Johnson Space Center	Goddard Space Flight Center, Jet Propulsion Laboratory
Subsystem:	**Major Contractors:**
Data Services Upgrades	Lockheed Martin

PROGRAM STATUS/NOTIFICATIONS/PLANS THROUGH 2002

The Ka-Band Ground Terminal Development activity continues in FY 2002. This effort seeks to demonstrate the commercial viability of providing high rate ground data acquisition in the Ka-Band area. This activity will include participation by members from various NASA centers and commercial vendors. The successful demonstration of this capability is scheduled for late FY 2002. Capabilities to be demonstrated are far beyond what is in operation today. Success will allow NASA and its commercial partners to take advantage of the new frequency allocations for space and earth science and to alleviate issues regarding radio frequency spectrum interference that exist today.

Work will continue in FY 2002 on various components of the Space Network Demand Access System (DAS). The Third Generation Beam Forming System development activity was completed to augment the TDRSS multiple-access capability and to permit customers to implement new operations concepts incorporating continuous return link communications. The DAS will expand existing Multiple Access (MA) return service capabilities by allowing customers to directly obtain services from the Space Network without scheduling through the NCC. The DAS will be installed at WSC and is expected to be operational and available for customer use in FY 2002.

JPL has also been working to decrease the Deep Space Network's complexity and improve equipment reliability; thereby enabling substantial DSN operations and maintenance cost savings. Efforts along these lines include improved network control, network simplification, upgrades to the 26-meter antenna subnet, and the replacement of aging electronics systems.

The Network Simplification Project (NSP) has continued on schedule. NSP consolidates or replaces all the telemetry and radiometric DSN equipment with new technology and commercial-off-the-shelf solutions that enable advanced capabilities and remote operations. The objectives include replacing failure-prone aging assemblies, reducing system interfaces, reducing manual switches, replacing old NASA-unique protocols with industry standards, and providing new deep space mission command services to eliminate labor-intensive controller functions. The final installations are planned for mid-2002 through 2003. The first-of-a-kind uplink and downlink replacement systems will be installed on the 34-meter beam wave-guide antenna at Goldstone for operational testing during FY 2002.

Implementation has begun on the telecommunications roadmap that was developed in FY 1998. The roadmap laid out a plan for using new technologies to increase the Deep Space Network's deep space communications capabilities to accommodate a growing exploration fleet while maximizing the utility of the existing DSN antennas. The first major goal of this implementation will be the addition of Ka-band reception capability on all of the Deep Space Network's 34-meter beam wave-guide antennas. An implementation plan was developed in FY 1999 that has successfully passed a preliminary definition and cost review, and has moved on to prototyping activities for certain key technologies. One of these technologies currently under test is a single microwave feed horn and associated cryogenic low-noise amplifiers that can receive both X-band (8 GHz) and Ka-band (32 GHz) simultaneously. The other significant effort undertaken as part of the telecommunications roadmap is the completion of the 34-meter antenna at Goldstone. The electronics for this antenna have been developed and are being installed to make this antenna operational in FY 2003.

NASA is planning for the future of the McMurdo Ground Station (MGS) in Antarctica. The drivers for this station are the need to provide for predictable performance of MGS in support of Launch and Early Orbit Operations, to provide for supplemental telemetry support, and to pursue a mutually beneficial relationship with the U. S. Air Force with regard to improved service and cost sharing. Concept definition, project plans, and approval to proceed were granted in FY 1999. Work will continue in FY 2002 to complete the implementation of a Joint Operations Center with the U. S. Air Force and subsystem upgrades in support of the Earth Observing Missions.

PROGRAM PLANS FOR FY 2003

The Network Simplification Project (NSP) will continue on schedule. The final installations are planned for completion by 2003. The electronics for the 34-meter antenna at Goldstone will be installed to make this antenna operational in FY 2003. Consistent with the new decentralized management process, we began the transition of Upgrades tasks to the appropriate Enterprises in FY 2002 and FY 2003. In FY 2004, the Enterprises will be fully responsible for funding all Upgrade requirements they believe are necessary to support their future needs.

BASIS OF FY 2003 FUNDING REQUIREMENT

TRACKING AND DATA RELAY SATELLITE REPLENISHMENT PROJECT

	FY 2001	FY 2002	FY 2003
		(Millions of Dollars)	
Spacecraft Development..	14.0	44.5	8.8
Launch Services..	36.9	73.0	7.7
Total...	50.9	117.5	16.5

DESCRIPTION/JUSTIFICATION

The Tracking and Data Relay Satellite (TDRS) Replenishment Project (TDRS H, I, J Spacecraft) is to provide three satellites to continue Space Network tracking, data, voice, and video services to NASA scientific satellites, the Space Shuttle, International Space Station, and to other NASA customers. These satellites are replacements to the current constellation of geosynchronous TDRS as they begin to exceed their lifetimes. The functional and technical performance requirements for these satellites will be virtually identical to those of the current Spacecraft except for improved multiple access and S-band single access performance, addition of Ka-band, and Spacecraft collocation. The three Spacecraft will be placed in orbit by expendable launch vehicles (ELV).

The Goddard Space Flight Center manages the development of the TDRS Replenishment Project, and the systems modification of the ground facilities and equipment as necessary to sustain network operations for current and future missions. The three TDRS Spacecraft, procured under a fixed-price contract, were awarded to the Hughes Space and Communications Company (now Boeing) in 1995. Lockheed Martin Corporation is the prime contractor for launch services for the TDRS Replenishment Spacecraft.

LINKAGES TO STRATEGIC AND PERFORMANCE PLANS

Strategic Plan Goals Supported:

- Enable humans to live and work permanently in space
- Enable the commercial development of space

Strategic Plan Objectives Supported:

- Meet sustained space operations needs while reducing costs
- Develop new capabilities for Human Space Flight and commercial applications through partnerships with the private sector

Performance Plan Metrics Supported:

1H20, 1H21

Milestones	**FY 2003 Budget**	**FY 2002 Budget**	**Baseline**	**FY 2002-FY 2003 Change**	**Comment**
Integrate and Test Complete H Spacecraft	November 1999	November 1999	January 1999	--	
Integrate and Test Complete I Spacecraft	August 1999	July 1999	June 1999	1 month	Impact of TDRS-I MA & Spacecraft integration rework
Integrate and Test Complete J Spacecraft	December 2001	December 2001	August 1999	--	
Launch H Spacecraft	6/00	6/00	7/99	0	TDRS-H launched 6/30/00
Available for Launch I Spacecraft	9/01	8/01	1/00	1	Impact of TDRS-I MA & Spacecraft integration rework
Available for Launch J Spacecraft	1/02	1/02	7/00	0	

Lead Center:	Other Centers:
Goddard Space Flight Center	Johnson Space Center, Kennedy Space Center, Jet Propulsion Laboratory, Glenn Research Center
Subsystems:	**Major Contractors:**
Spacecraft	Boeing
Payload	Lockheed Martin
Ground Modifications	

PROGRAM STATUS/NOTIFICATIONS/PLANS THROUGH 2002

The TDRS-8 Spacecraft was launched successfully on June 30, 2000 with on-orbit checkout completed in September 2000. The Spacecraft is working well and meets all user service telecommunications performance requirements, except for a Multiple Access (MA) performance anomaly. As a result of an investigation, Boeing and NASA have executed a settlement agreement that results in a $35 million dollar credit to the Spacecraft contract. This is reflected in our revised FY 2002 operating plan as a credit of $8 million dollars and our FY 2003 budget request as a credit of $27 million dollars.

Changes to the TDRS-I and -J Spacecraft flight hardware and test program as a result of the MA investigation will be completed prior to the completion of environmental and final functional testing of the Spacecraft. Environmental testing for TDRS-I was completed in June 2001 and final functional testing occurred in November 2001. Launch is planned for March 2002. The environmental testing for TDRS-J was completed in November 2001 and final functional testing is scheduled for January 2002.

PROGRAM PLANS FOR FY 2003

The launch of TDRS-J is scheduled for October 2002.

TDRSS REPLENISHMENT LIFE CYCLE COST DATA

$ in Millions	Prior	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	BTC	Total
Initial Baseline	**714.4**	**70.0**	**97.8**	**54.5**						**936.7**
FY03 President's Budget	**618.2**	**50.9**	**117.5**	**16.5**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**803.1**
Development	486.8	14.0	44.5	8.8						554.1
Launch Services	131.4	36.9	73.0	7.7						249.0

BASIS OF FY 2003 FUNDING REQUIREMENT

TECHNOLOGY INFUSION

	FY 2001	FY 2002	FY 2003
	(Millions of Dollars)		
Advanced Communications.	12.0	13.9	13.6
Space Internet.	2.1	0.6	0.3
Virtual Space Presence	4.7	--	--
Autonomous Mission Operations	5.9	0.9	--
Advanced Guidance, Navigation, and Control	3.9	2.6	1.0
Standards.	4.8	2.5	2.6
Technology Program Support	2.4	--	--
Total	35.8	20.5	17.5

DESCRIPTION/JUSTIFICATION

The objective of the Space Communications Technology Infusion Project is to identify, develop, integrate, validate, and transfer/infuse advanced technologies that will increase the performance, provide new capabilities, and reduce the costs of providing data services to the Space Communications and Data Systems (SCDS) customers. The Technology project serves to reduce the cost of SCDS services, or provide the technology advancement to allow the introduction of new services to the overall Space Communications Architecture.

The SCDS strategy for achieving technology goals is to define five specific campaigns that address unique technology needs across the NASA Enterprises. In defining the activities in each of these campaigns, SCDS works closely with the relevant Enterprises to understand their needs and focus on those activities of greatest potential for enabling future missions and reducing the cost of communications and data services. The five campaigns are described below. In addition, funds are requested for Agency standards activities. This provides infusion of new protocols and information system standards to meet space communications and mission operations of NASA and international partners. This budget program support provides funds to cover field center institutional assessments.

Advanced Communication

The focus of this campaign is development of telecommunications technologies to increase data return and decrease costs for support of NASA's missions. The Advanced Communication Campaign is committed to the development of high performance communication technologies for use in future NASA Spacecraft and the ground and space assets that support them. The new communication technologies and more efficient implementation schemes will enable or augment future NASA missions with enhanced, lower cost communication services and allow the scientific community to perform more and better research by providing them with access to greater overall communication system bandwidth. The mission of the Advanced Communication Campaign is to identify, develop, and infuse high performance communications technologies necessary to enable or enhance mission data services and to achieve seamless interoperability among NASA, commercial satellite, and terrestrial communications systems.

This campaign has focused work areas supporting the unique low signal levels of Deep Space, high data rates for Near Earth, and low size, weight, power, and cost components for all missions. Activities related to the development and validation of a wide variety of radio frequencies, including Ka-band, for relief of spectrum congestion and optical devices (antennas, receivers, transmitters, modems, and codes) are part of this campaign.

Space Internet

Supporting the Integrated Operations Architecture (IOA) vision for transparent operations, the Space Internet Campaign seeks to provide users direct access to tools, payloads, and data. The mission of the Space Internet Campaign is to identify, develop, and infuse Internet and supporting communications infrastructure technologies necessary to achieve seamless interoperability between satellite and terrestrial networks. For Near Earth and near planetary missions, the Space Internet Campaign is committed to the extension of commercially available, terrestrial-based Internet technologies into future NASA Spacecraft to enhance the capabilities for remote access and control of space-based assets. Deep Space missions will require new communications protocols and new relay telecommunications. The long round-trip light times, intermittent link availability, and extremely low signal-to-noise ratio of deep space links demand carefully tailored protocols to achieve the kinds of high-level file transfer capabilities that we take for granted in today's terrestrial Internet. Within this campaign, we will develop new deep space protocols, test and validate them in protocol testbeds, and infuse them into new radios that provide high-level communication and navigation functionality in low-mass, power-efficient, highly interoperable systems. This campaign also includes activities related to development and validation of space qualified code, local area network (LAN), routing, and switching hardware and software.

Virtual Space Presence

As we gather more detailed science information in remote locations, and rely more heavily on robotic exploration and autonomous operations, we must shift how we plan, operate, and visualize these activities. These technologies provide improved science return through advanced tools for high fidelity 3-D visualization of planned and executed Spacecraft activities, and the ability to remotely plan activities and display the results, enable distributed team operations and broad outreach by providing secure access to science and mission information resources.

Autonomous Mission Operations

This campaign will enable the planning, design, development, and operation of missions with challenging observational or exploration scenarios. These include autonomous decision-making and control for complex navigation and guidance scenarios, collaborative robotic exploration of remote bodies or terrain, autonomous observation planning and optimization of information return, and hazard avoidance and autonomous maintenance of Spacecraft operational safety. Model-based system design and operation, goal-oriented planning, and related advanced testing techniques for autonomous systems are essential elements of these approaches. System automation to increase information handling and effective science return, automate system responsiveness to operational activities and Spacecraft driven service requests, and automated detection and response to unplanned events are elements of this campaign.

Advanced Guidance, Navigation and Control (GN&C)

Enabling the planning, design, development, and operation of missions with challenging navigation scenarios is the Advanced GN&C Campaign. Scenarios include autonomous navigation and guidance, autonomous formation flying and constellation operations, and operation in complex gravitational fields. Many of these mission scenarios require highly responsive guidance approaches with control loops closed on the Spacecraft rather than between Spacecraft and ground. Autonomous maneuver decision-making, planning, and execution techniques are being extended to enable distributed networks of individual vehicles to interact with one another and act collaboratively as a single functional unit. The activities in this campaign include the techniques and subsystems to enable the relative positions and orientations of vehicles to be determined; formation flying control architectures, strategies, and management approaches; inter-Spacecraft communication techniques for constellation coordination; and assessments of ground/flight operations concepts, trades, and accommodation requirements. Global positioning system (GPS) technologies that have been utilized for applications at the Earth are being evaluated and extended to support autonomous navigation for non-low earth orbit missions.

LINKAGES TO STRATEGIC AND PERFORMANCE PLANS

Strategic Plan Goals Supported:
- Enable humans to live and work permanently in space
- Enable the commercial development of space

Strategic Plan Objectives Supported:
- Meet sustained space operations needs while reducing costs
- Develop new capabilities for Human Space Flight and commercial applications through partnerships with the private sector.

Performance Plan Metrics Supported: 1H20, 1H21

Milestones	FY 2003 Budget	FY 2002 Budget	FY 2001 Budget	FY 2002-FY 2003 Change	Comment
Disseminate Advanced Communication Technology Satellite (ACTS) experiment results and complete data and record archiving	3rd Qtr FY 2002	4th Qtr FY 2001	4th Qtr FY 2001	3 Qtrs later	Overall experiment results will be catalogued and made available through the ACTS Web Page (http://acts.grc.nasa.gov) pending resolution of website public access concerns.
Develop SiGe-based power amplifier	4th Qtr FY 2002	4th Qtr FY 2002	4th Qtr FY 2002		Contingent on execution of a Space Act Agreement with Boeing, develop a Ku-band Silicon-Germanium-based power amplifier MMIC design for a phased-array antenna transit module.
Common Planning and Scheduling System (COMPASS) design review for distributed constellation planning	4th Qtr FY 2001	4th Qtr FY 2001	4th Qtr FY 2001		COMPASS capability extended to provide flight planning and scheduling in addition to science planning. COMPASS has been incorporated into the Advanced Visual Tools and Architecture Project Build 1 prototype. COMPASS is expected to reduce the cost of mission planning while enabling planning for distributed, independent and/or cooperative observatories (constellations). Project concluded in FY 2001.
Advanced Visual Tools and Architectures (AVATAR) project TAR Build 1 prototype release	2nd Qtr FY 2001	2nd Qtr FY 2001	2nd Qtr FY 2001		Zoomable Unit Interface, Data Carousel implemented, and Health Modeling design complete. Project concluded in FY 2001.
Demonstration of Deep Space Station Controller (DSSC) prototype	2nd Qtr FY 2002	4th Qtr FY 2001	4th Qtr FY 2001	2 Qtrs later	Includes model-based health monitoring and diagnosis. Slipped due to scheduling issues with the DSN.
Reconfigurable Radio Test Bed Demo	4th Qtr FY 2001	4th Qtr FY 2001	4th Qtr FY 2001		Radiometric navigation and telecommunications between multiple vehicles at Mars.

Milestones	FY 2003 Budget	FY 2002 Budget	FY 2001 Budget	FY 2002-FY 2003 Change	Comment
Optical Communications Technology Laboratory (OCTL) First Light	1st Qtr FY 2002	1st Qtr FY 2002	1st Qtr FY 2001	1 year later	OCTL development completed and delivery and installation of 1M-diameter telescope at Table Mountain. Performance Validation initiated. The slip for this milestone can be attributed to a delay in the actual placement of the contract, and difficulties in telescope development. No budget growth, no customer impact.
Ka-band TWTA Protoflight model delivery	4th Qtr FY 2002	3rd Qtr FY 2002	3rd Qtr FY 2002	1 Qtr later	24W EOL Traveling Wave Tube Amplifier with greater than 40% efficiency. A key technology in enabling Ka-band communications. Contract option to raise power to 35W picked up, based on success early success; option included later delivery of Protoflight model.
Communications and Navigation Demonstration on Shuttle (CANDOS)	3rd Qtr FY 2002		3rd Qtr FY 2002		A Shuttle-based demonstration of the first generation Low Power Transceiver (LPT)

Lead Center:
Johnson Space Center

Other Centers:
Goddard Space Flight Center, Jet Propulsion Laboratory, Marshall Space Flight Center, Kennedy Space Center, Glenn Research Center

Major Contractors:
Computer Sciences Corporation
Zin
Analex

PROGRAM STATUS/NOTIFICATIONS/PLANS THROUGH 2002

A low power transceiver is being developed for near earth missions which will allow the unit to process multiple channels allowing simultaneous Tracking and Data Relay Satellite System (TDRSS) and Global Positioning System (GPS) signal reception. In FY 2001, the Field Programmable Gate Array (FPGA)-based transceiver completed ground-based demonstration of a 2nd generation prototype capable of processing 16 channels. A Shuttle-based demonstration of the first generation LPT is scheduled for FY 2002.

The Advanced Visual Tools and Architectures (AVATAR) project applied visualization technology to Spacecraft engineering data analysis in order to increase operator performance in multi-mission, constellation, and lights-out environments.
Key technologies needed to enable utilization of Ka-band communications on future deep space missions will continue. A contract has been awarded for the development of a 27 Watt (24 Watt at end-of-life) space-qualified Ka-band Traveling Wave Tube Amplifier which is more than 40% efficient. Delivery is expected in the third quarter of FY 2002. A small profile rigid X/Ka-band antenna with high illumination efficiency is also under development. For the ground-receiving end, development of a Ka-band multi-cavity maser low noise amplifier will be demonstrated. Additionally, a combination deformable plate mirror and array feed compensation system will be developed and demonstrated to compensate for large DSN antenna distortions due to gravity and wind buffeting.

Development of the Optical Communications Telescope Laboratory (OCTL) will continue. The 1m-diameter telescope will be delivered and "first light" is planned for first quarter of FY 2002. The OCTL facility on Table Mountain in California will be used to demonstrate and validate optical communications techniques; components and systems level performance for application to NASA's future high capacity near-Earth and deep-space communications needs. The network of three Atmospheric Visibility Monitoring telescopes will continue to collect data, which will be used to assess statistics of optical signal propagation through the atmosphere. Models from these data will be used to evaluate optical link performance for future mission applications.

The Autonomous Formation Flyer (AFF) development has been infused into the New Millennium Program's Space Technology 3 program. A derivative of the AFF, a software reconfigurable Spacecraft transceiver processor prototype, is being developed to provide radiometric navigation and telecommunications between multiple vehicles at Mars. The design will be capable of reconfiguration from the ground through uploads of new software or Field Programmable Gate Array (FPGA) code.

Development of the Deep Space Station Controller (DSSC) prototype will continue and will lead to a demonstration of automated downlink operations in an actual DSN environment. The DSSC is developing an architecture and prototype for achieving station-centric automated control and employs AI-based methods for system health monitoring, diagnosis, and recovery. The monitoring and diagnosis portion of the prototype will employ the BEAM technology, which utilizes a combination of deterministic and stochastic models to monitor system health. Automation of recovery actions is achieved through the Closed-loop Execution and Recovery (CLEaR) technology, which employs continuous planning and execution capabilities. A prototype of the Deep Space Station Controller (DSSC) was demonstrated successfully in the fourth quarter of FY 2001.

The ACTS experiments program officially concluded with the ACTS Conference held in conjunction with the 6th International Ka-band Utilization Conference in May 2000. Instead of ceasing all operations and rendering the Spacecraft inert, NASA transferred ACTS to a university-based consortium. The Ohio Consortium for Advanced Communications Technology (OCACT) was formed in

FY 2001. NASA has been fully reimbursed for operations costs. In FY 2002, NASA plans to extend the operating license past FY 2001 (via IRAC with FCC approval) and provide minimal oversight of Spacecraft operations in exchange for experimental access to the payload to support the communications technology project. The OCACT will pursue an experimental license with the FCC for its use of the communications payload.

PROGRAM PLANS FOR FY 2003

The programmatic priorities for FY 2003 are to complete activities currently underway. Consideration will be given to high potential Technology Infusion tasks requiring no more than one year of funding to reach a significant milestone. Consistent with the new decentralized management process, we began the transition of Technology Infusion tasks to the appropriate Enterprises in FY 2002 and FY 2003. In FY 2004, the Enterprises will be fully responsible for identifying and funding all future Technology Infusion requirements that they believe are necessary to support their future needs.